CLAIMS

1. A rotary compressor, comprising:

a shaft rotatable about an axis;

at least one compressor wheel mounted on said shaft for rotation therewith and having an inlet end of relatively small diameter and a radial discharge end of relatively large diameter;

a nominally donut-shaped intercooling heat exchanger centered about said shaft and adjacent said turbine wheel, said heat exchanger having heat exchange fluid flow paths in heat exchange relation with each other including a compressed gas flow path and a coolant flow path, said coolant flow path being bounded in part by a wall of a diameter at least as great as said relatively large diameter;

a housing for said compressor wheel and said heat exchanger and together with said wall defining a compressed gas directing space extending from said radial discharge end to an entrance to said compressed gas flow path; and

a plurality of flow straightening vanes thermally coupled to said wall and extending across said compressed gas directing space so that heat in said compressed gas may be rejected to said vanes and then to coolant in said coolant flow path.

2. The rotary compressor of claim 1 wherein said wall is generally radially extending and on an end of said heat exchanger closest to said compressor wheel and includes a section of greater diameter than said relatively large diameter, said vanes extending generally radially and being aligned with said section.

3. The rotary compressor of claim 2 wherein said vanes are mounted on said wall at said section.

4. The rotary compressor of claim 2 wherein said vanes are thermally coupled to said section of said wall by metallurgical bonding.

5. The rotary compressor of claim 1 wherein said heat exchanger includes plural pairs of plates, the plates of each pair being centrally apertured and having a generally circular outer axially directed peripheral wall and a generally circular inner axially directed peripheral wall with a generally flat area extending between said peripheral walls and radially directed flanges on each peripheral wall axially spaced from the flat area of the corresponding plate, the flanges on the plates of each pair being secured and sealed together to define a flattened nominally donut-shaped unit defining annular flow parts of said coolant flow path, said pairs of plates being alternatingly stacked with fin structures extending between radially inner and outer peripheral walls to define radial flow parts of said compressed gas flow paths, there being one of said units on each axial end of said heat exchanger with the flat area of one of the plates of said one unit defining said wall.

6. The rotary compressor of claim 5 wherein each fin structure is a circular serpentine fin having circumferentially alternating crests and valleys with the crests thereof in heat exchange thermal contact with units between which each fin is located.

7. The rotary compressor of claim 6 wherein each of said units includes a radially outwardly directed tab with the tab of each unit being aligned with the tabs of each other unit throughout the stack, the tabs of each unit further extending radially outwardly past the serpentine fins and axially into sealed engagement with each other, two apertures in each tab establishing fluid communication between the units in the stack and a flow blocking portion extending across the flat areas of each plate of each unit between the radially inner peripheral walls and the radially outer wall of the tab and at a location between the two apertures of each tab.

8. A rotary compressor, comprising:

a shaft rotatable about an axis;

at least one compressor wheel mounted on said shaft for rotation therewith and having an inlet end of relatively small diameter and a radial discharge end of relatively large diameter;

a nominally donut-shaped intercooling heat exchanger centered about said shaft and adjacent said turbine wheel, said heat exchanger having heat exchange fluid flow paths in heat exchange relation with each other including a compressed gas flow path and a coolant flow path, said coolant flow path being bounded in part by a wall of a diameter at least as

great as said relatively large diameter, said heat exchanger including plural pairs of plates, the plates of each pair being centrally apertured and having a generally circular outer axially directed peripheral wall and a generally circular inner axially directed peripheral wall with a generally flat area extending between said peripheral walls, and radially directed flanges on each peripheral wall axially spaced from the flat area of the corresponding plate, the flanges on the plates of each pair being secured and sealed together to define a flattened, nominally donut-shaped unit defining annular flow parts of said coolant flow path, said pairs of plates being alternatingly stacked with fin structures extending between said radially inner and outer peripheral walls defining radial flow parts of said compressed gas flow path, there being one of said units on each axial end of said heat exchanger with the flat area of one of the plates of said unit defining said wall, each said fin structure being a circular serpentine fin having circumferentially alternating crests and valleys with the crests thereof in heat exchange thermal contact with units between which each fin is located, each of said units further including inlet and outlet ports with the inlet and outlet ports of each unit being aligned with and sealed to the inlet and outlet ports of each adjacent unit in the stack;

inlet and outlet fixtures mounted and sealed to the inlet and outlet of one of said units; and

a housing for said compressor wheel and said heat exchanger and together with said wall defining a compressed air directing space extending from said radial discharge end to an entrance to said compressed air path.

9. The rotary compressor of claim 8 including an additional one of said compressor wheels in axially spaced relation on said shaft to said at least one compressor wheel and there are two of said walls and axially spaced from each other, one adjacent said discharge end of said at least one compressor wheel and one adjacent the discharge end of said additional compressor wheel.

10. The rotary compressor of claim 9 further including first and second sets of flow straightening vanes, one set being mounted on one of said walls in thermally coupled relation therewith and another set being mounted on the other of said walls in thermally coupled relation therewith.

11. The rotary compressor of claim 9 wherein there are serpentine fins on each of said two walls, one adjacent the discharge end of each of said compressor wheels.

12. The rotary compressor of claim 8 wherein each of said units includes a radially outwardly directed tab with the tab of each unit being aligned with the tabs of the other units throughout said stack, the tab of each further extending radially outwardly past the serpentine fins, said inlet and outlet ports including aligned apertures in said tabs.

13. The rotary compressor of claim 12 wherein said ports further include axially directed collars surrounding said aligned apertures and engaging and sealed to collars of the adjacent tabs and establishing fluid communication between the apertures, and thus the units, in the stack, and flow blocking partition extending across flat areas of each plate of each unit between the radially inner and outer peripheral walls thereof at a location between said inlet ports and said outlet ports.

14. The rotary compressor of claim 12 where each said tab extends axially into sealed engagement with adjacent tbs about said apertures.

15. The rotary compressor of claim 14 wherein each said tab extends axially into said sealed engagement by means of axially directed collars surrounding said aligned apertures.

16. The rotary compressor of claim 15 wherein adjacent sealed collars telescope into one another.

17. The rotary compressor of claim 12 wherein each said unit includes two of said tabs, said two tabs being circumferentially spaced about said circular outer axially directed peripheral wall, and said inlet parts are in one of the tabs of each said unit and said outlet ports are in the other of the tabs of each said unit.

18. The rotary compressor of claim 8 further including at least one circumferential flow director within each said unit at a location radially inward of said outer axially directed peripheral wall and radially outward of said inner axially directed peripheral wall, said outlet ports being in fluid communication with a first space between one of said peripheral walls and said flow director and said inlet ports being in fluid communication with a second space between the other of said peripheral walls and said flow director.

19. The rotary compressor of claim 18 further including a port in each of said flow directors at a location remote from said inlet and outlet ports establishing fluid communication between said first and second spaces.

20. A rotary compressor, comprising:

a shaft rotatable about an axis;

at least one compressor wheel mounted on said shaft for rotation therewith and having an inlet end of relatively small diameter and a radial discharge end of relatively large diameter;

a nominally donut-shaped intercooling heat exchanger centered about said shaft and adjacent said turbine wheel, said heat exchanger having heat exchange fluid flow paths in heat exchange relation with each other including a compressed gas flow path and a coolant flow path, said coolant flow path being bounded in part by a wall of a diameter at least as great as said relatively large diameter, said heat exchanger including plural

pairs of plates, the plates of each pair being centrally apertured and having a generally circular outer axially directed peripheral wall and a generally circular inner axially directed peripheral wall with a generally flat area extending between said peripheral walls, and radially directed flanges on each peripheral wall axially spaced from the flat area of the corresponding plate, the flanges on the plates of each pair being secured and sealed together to define a flattened, nominally donut-shaped unit defining annular flow parts of said coolant flow path, said pairs of plates being alternatingly stacked with fin structures extending between said radially inner and outer peripheral walls defining radial flow parts of said compressed gas flow path, there being one of said units on each axial end of said heat exchanger with the flat area of one of the plates of said unit defining said wall, each said fin structure being a circular serpentine fin having circumferentially alternating crests and valleys with the crests thereof in heat exchange thermal contact with units between which each fin is located, each of said units including aligned inlet and outlet ports for the annular flow parts of said coolant flow path, said inlet and outlet ports including aligned apertures in said plates.

21. The rotary compressor of claim 20 wherein said apertures are surrounded by axially directed collars, aligned ones of said collars being sealed to one another.

22. The rotary compressor of claim 21 wherein said collars are integral with their respective plates and telescope into one another.

23. The rotary compressor of claim 22 further including flow directors in each of said units separating said inlet and outlet ports to cause flow through said annular flow parts.

24. The rotary compressor of claim 23 wherein said flow directors are circumferentially directed.

25. The rotary compressor of claim 23 wherein said flow directors are radially directed.

26. The rotary compressor of claim 20 wherein one of said units additionally includes a radially directed tab and inlet and outlet fixture mounted to said tab and being respectively in fluid communication with the inlet and outlet ports in said one unit.

27. The rotary compressor of claim 26 wherein said one unit has an annular flow part of greater cross-sectional area than the annular flow part of the other of said units.